GUJARAT TECHNOLOGICAL UNIVERSITY
MCA Integrated - SEMESTER– IV- EXAMINATION – WINTER 2018

Subject Code: 4440602   **Date: 01-12-2018**
Subject Name: Operations Research (OR)
Time: 02.30 pm to 5.00 pm   **Total Marks: 70**
Instructions:
   1. **Attempt all questions.**
   2. **Make suitable assumptions wherever necessary.**
   3. **Figures to the right indicate full marks.**

Q.1 **(a)** Comment on the following statement   **07**
i) OR is the art of winning war without actually fighting it.
ii) OR is the art of finding bad answers where worse exists

(b) What is Linear Programming? Explain the basic components of an LP model.   **07**
Also state its assumptions

Q.2 **(a)** Solve the following LP problem using graphical method.   **07**
Minimize $Z = 3x_1 + 2x_2$
Subject to constraints
$5x_1 + x_2 \geq 10$
$x_1 + x_2 \geq 6$
$x_1 + 4x_2 \geq 12$
and $x_1, x_2 \geq 0$

(b) A tape recorder company manufactures models A, B and C, which have profit   **07**
contributions per unit of Rs 15, Rs 40 and Rs 60, respectively. The weekly
minimum production requirements are 25 units for model A, 130 units for
model B and 55 units for model C. Each type of recorder requires a certain
amount of time for the manufacturing of the component parts, for assembling
and for packing. Specifically, a dozen units of model A require 4 hours for
manufacturing, 3 hours for assembling and 1 hour for packaging. The
corresponding figures for a dozen units of model B are 2.5, 4 and 2 and for a
dozen units of model C are 6, 9 and 4. During the forthcoming week, the
company has available 130 hours of manufacturing, 170 hours of assembling
and 52 hours of packaging time. Formulate this problem as an LP model so as
to maximize the total profit to the company (Do not solve).

OR

(b) Construct the dual of the problem   **07**
$\text{Min}_z = 3x_1 - 2x_2 + 4x_3$
Subject to
$3x_1 + 5x_2 + 4x_3 \geq 7,$
$6x_1 + x_2 + 3x_3 \geq 4,$
$7x_1 - 2x_2 - x_3 \leq 10,$
$x_1 - 2x_2 + 5x_3 \geq 3,$
$4x_1 + 7x_2 - 2x_3 \geq 2,$

and $x_1, x_2, x_3 \geq 0.$

Q.3 **(a)** Find the optimal solution of the following transportation problem: **07**

Plants	Ware houses				
	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

(b) Explain the Hungarian Assignment Method. Is it better than other methods of solving assignment problem? How? **07**

OR

Q.3 **(a)** A construction company has requested bids for subcontracts on five different projects. Five companies have responded their bids and are represented below: **07**

	Bid amounts ('000$_s$ Rs)				
Bidders	A	B	C	D	E
1	41	72	39	52	25
2	22	29	49	65	81
3	27	39	60	51	40
4	45	50	48	52	37
5	29	40	45	26	30

Determine the minimum cost assignment of subcontracts to bidders, assuming that each bidder can receive only one contract

(b) What is Simulation? Explain the types of simulation. **07**

Q.4 **(a)** In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average of 36 minutes. Calculate the following:
(i)The average number of trains in a queue.
(ii)The probability that the queue size exceeds 10.
(iii)Expected waiting time in a queue. **07**

(b) What are the three time estimates used in the context of PERT? How are the expected duration of a project and its standard deviation calculated? **07**

OR

Q.4 **(a)** (i) For what value of λ, the game with following pay-off matrix is strictly determinable? **04**

	Player B		
	B1	B2	B3
A1	λ	6	2
A2	-1	λ	-7
A3	-2	4	λ

(ii) Define the terms:
(1) saddle point   (2) fair game   (3) payoff matrix **03**

(b) What is Replacement? Explain briefly the replacement policies of items whose efficiency deteriorates with time. **07**

Q.5 **(a)** Ten jobs are to be processed on two machines M1 and M2. Determine the optimal sequence and evaluate the total elapsed time, besides the job and machine idle time. The job processing times (in hours) are given below in table. **07**

Machines	Job processing times in hours									
	J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8	J_9	J_{10}
M_1	8	9	10	4	8	5	6	9	6	7
M_2	5	3	7	7	6	8	3	7	8	7

(b) What are inventory models? Enumerate various types of inventory models and describe them briefly **07**

OR

Q.5 **(a)** Determine the optimal sequence of performing 4 jobs on 5 machines. The matching of each machine is required in the order ABCDE and the process timings as as follows. **07**

Jobs	Machines				
	A	B	C	D	E
I	7	5	2	3	9
II	6	6	4	5	10
III	5	4	5	6	8
IV	8	3	3	2	6

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find idle time for all machines.

(b) What is queue? Explain the structure of the queuing system. **07**

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